National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

AIRS v5.0 Level 3 Products

AIRS Science Team Meeting
Pasadena, CA
March 27-30, 2007

Stephanie Granger, Sung-Yung Lee, Evan Manning
Jet Propulsion Laboratory
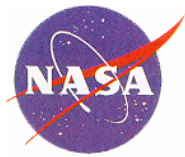California Institute of Technology

Summary

- New products in v5.0 Standard Level 3
  - 17 new products
  - Error estimates for IR measurements

- Improved QC
  - Quality control tied to error estimates
    - Quality flags are set based on error estimate thresholds
      - Zero means best quality used in statistics and level 3
      - One means good quality used in level 3 processing
      - Two means poor quality, not used

- Level 3 Support Products new in v5.0
  - Based on Level 2 Support

New Products in Level 3 v5.0

- New Parameters
  - Error estimates reported for all IR parameters
  - Trace gases
    - CH4
    - CO
  - Cloud Profiles
    - Fine
    - Coarse
  - Tropopause
    - T, P, Height (meters)
  - Relative Humidity Liquid
- Location parameter
  - Topography (DEM)
    - Topography of the Earth in meters above the geoid
    - Source = PGS Toolkit
- New Attributes
 - Trace gas support

v5.0 Level 3 Samples and Some Comparisons

- CH4
- CO
- Tropopause parameters
- Cloud Profiles
- v4 VS v5
- OLR: CERES, NCEP
    - Expect improvement in bias
- SST: RTG-SST

Granger, Lee, Manning

New
v5.0 Level 3 CO Products

- CO VMR reported at 7 trapezoid layers
- CO effective pressure at 7 trapezoid layers
- CO Total column
  - mol/cm^2
- CO DoF
- CO Verticality
- Supporting Attributes
  - COTrapLyrNum
  - CO_TrapezoidLayers

Mean CO VMR

August 2005

~505 hPa

CO VMR, ppbv

80.   103.   125.   148.   171.
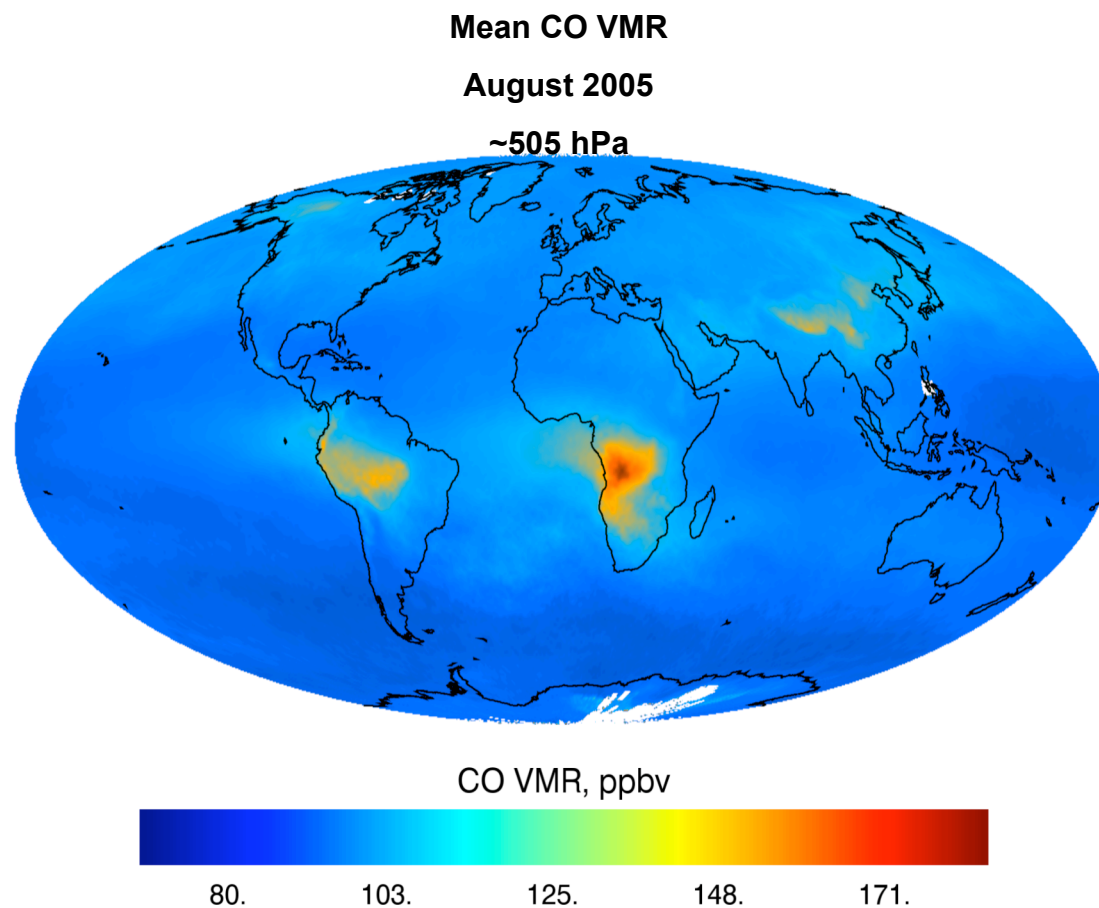
New
v5.0 Level 3 CH4 Products*
* Experimental, not yet validated

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

- CH4 VMR
  - 3 trapezoid layers
- CH4 effective pressure
  - 3 trapezoid layers
  - CH4 DoF
- Supporting attributes
  - Ch4TrapLyrNum
  - CH4_TrapezoidLayer

**AIRS Mean CH4
8-Day Level 3
August 2005**
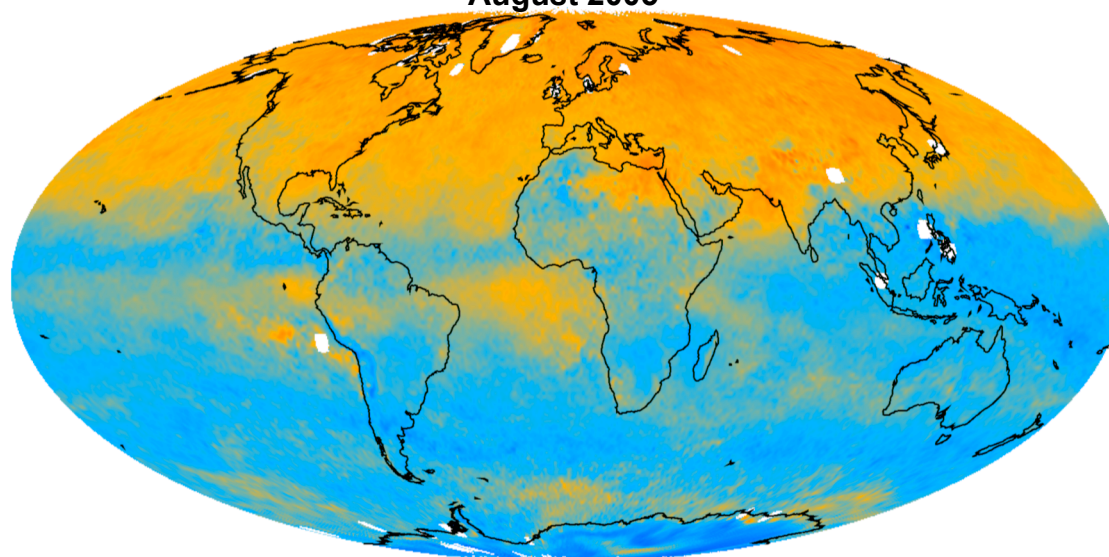
CH4, ppbv
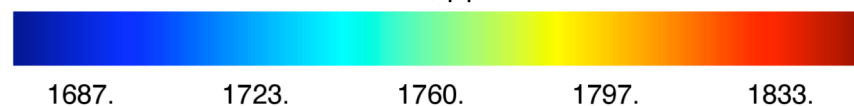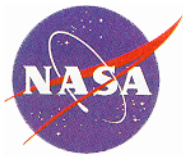
1687.   1723.   1760.   1797.   1833.

March 29, 2007
Granger, Lee, Manning

New
v5 L3 Tropopause Products*

*Experimental, not yet validated

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

- Tropopause Pressure (hPa)

- Tropopause Temperature (K)

- Tropopause Height (meters)

**AIRS 8-day Mean Tropopause Pressure
August 2005**

Tropopause Pressure, hPa

132.   175.   218.   260.   302.
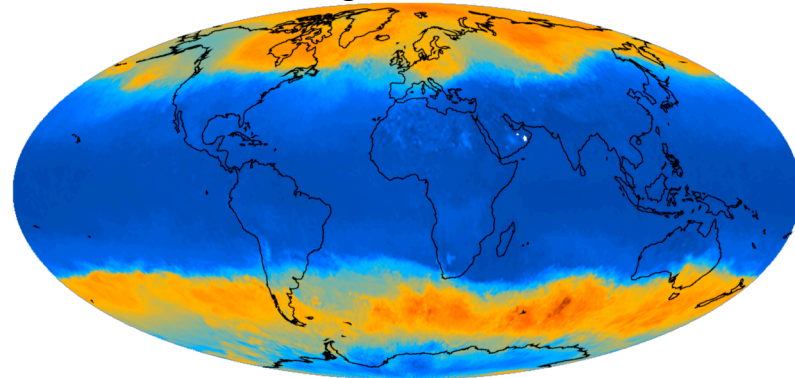
**AIRS 8-day Mean Tropopause Temperature
August 2005**

Tropopause Temperature, Kelvin

184.   194.   203.   212.   222.

March 29, 2007
Granger, Lee, Manning

New
Cloud Profile Products
v5.0.11

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

AIRS Mean Coarse Cloud Fraction
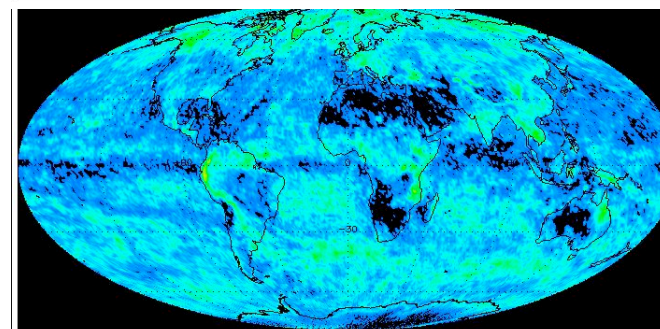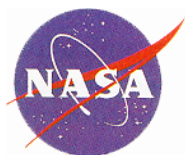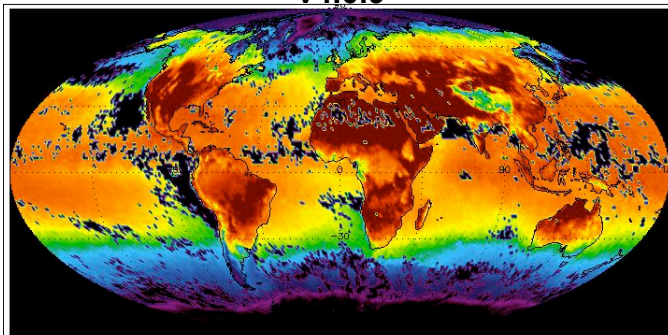**v5.0 Level 3**
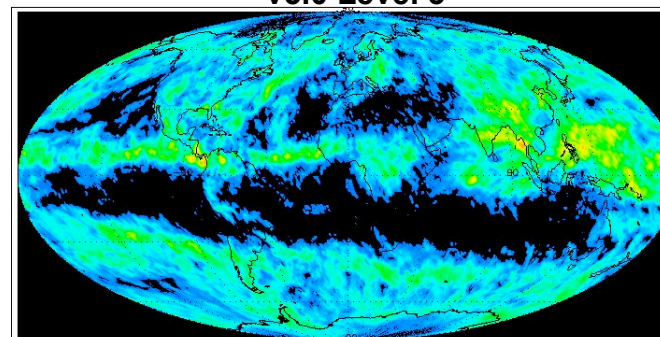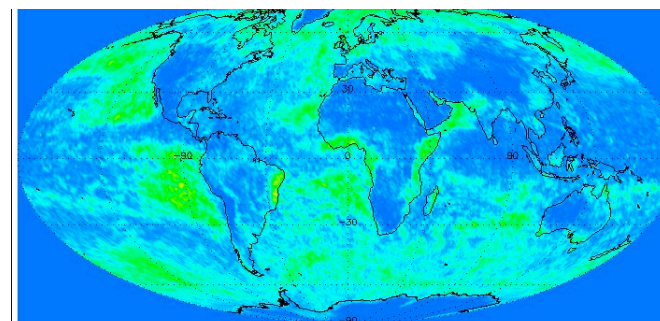
- Coarse cloud profile
  - 3 Layers (Low, Middle, High): 680, 440 hPa
  - Fraction
    - Sum over all layers in a grid cell of Coarse Clouds = Total clouds
  - Temperature
  - Pressure
- Fine cloud profile
  - 12 Layers
    - Sum over all layers in a grid cell of Fine Clouds = Total clouds
    - 12 layers: 1100, 925, 850, 700, 600, 500, 400, 300, 250, 200, 150, 100, 10 hPa
  - Fraction

High

Mid

Low

March 29, 2007
Granger, Lee, Manning

8

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

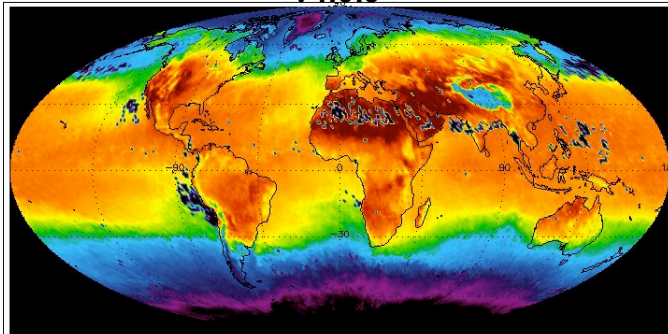# v4.0.9 vs v5.0.11
August 2005 8-day
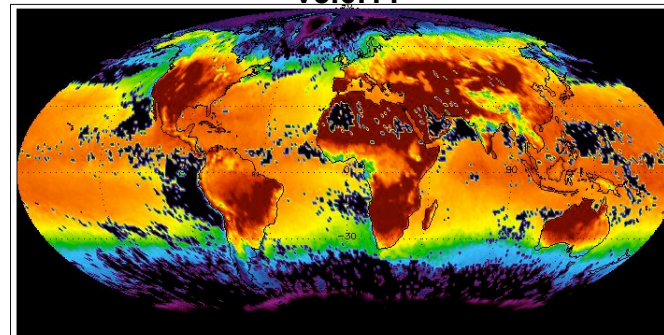## Ascending Node

AIRS SST
v4.0.9

SST, Kelvin
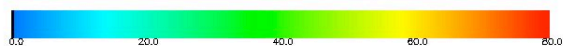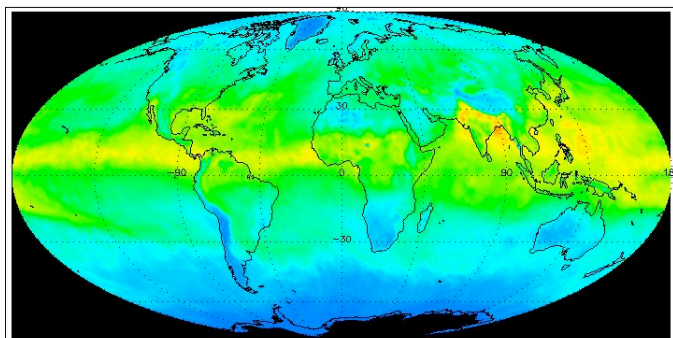260   285   310

AIRS SST
v5.0.11

SST, Kelvin
260   285   310

AIRS Surface Air Temperature
v4.0.9

SST, Kelvin
260   285   310

AIRS Surface Air Temperature
v5.0.11

SST, Kelvin
260   285   310

V4.0.9 vs v5.0.11
August 2005 8-day

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
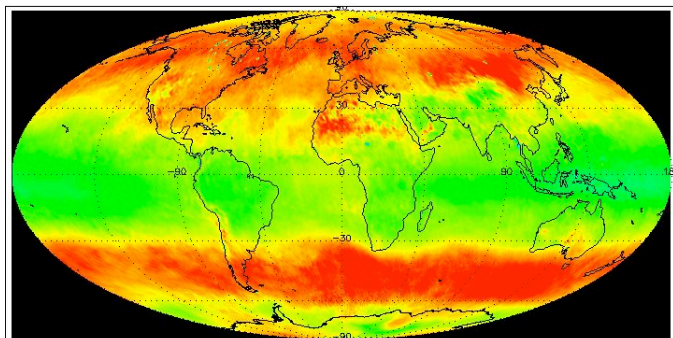Pasadena, California

Total Water Vapor
v4.0.9

Total Water Vapor
v5.0.11
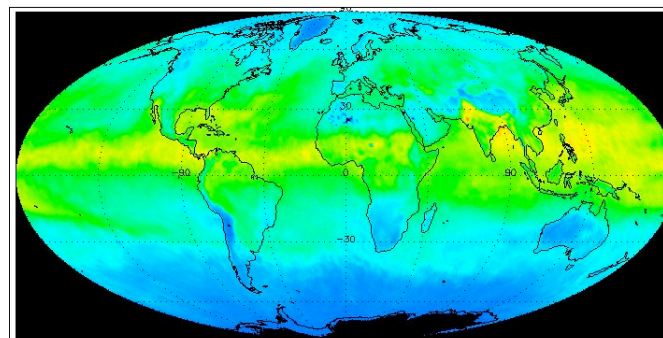
Total O3
v4.0.9

Total O3
v5.0.11
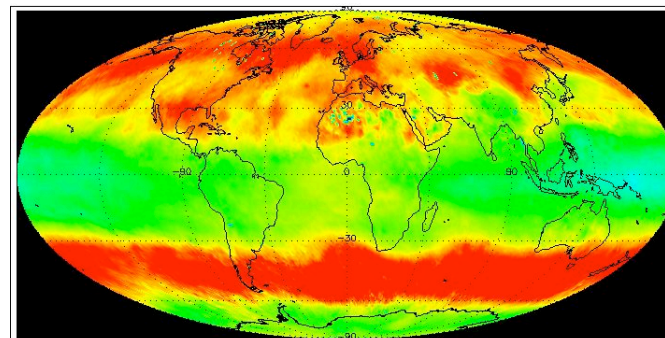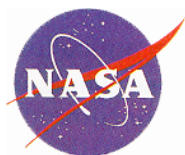
10

RTG SST and AIRS v5.0.7 SST
August 2005
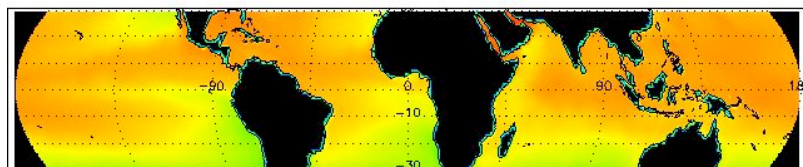
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

RTG-SST

**AIRS SST
Ascending, Descending**

SST, Kelvin

260   285   310

SST, Kelvin

260   285   310
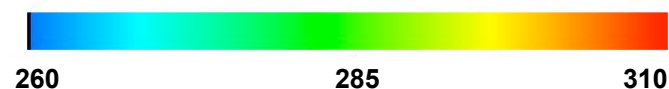
**AIRS SST
Descending**
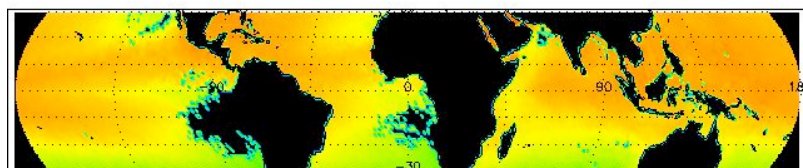
**AIRS SST
Ascending**

SST, Kelvin

260   285   310

SST, Kelvin

260   285   310

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

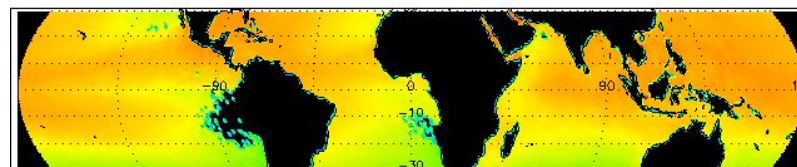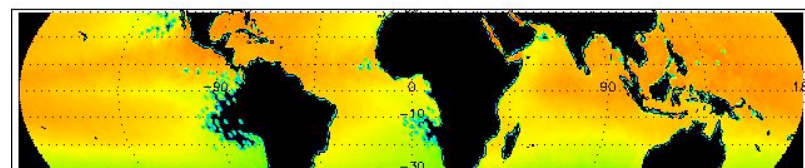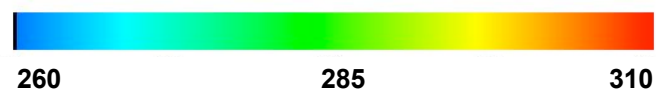- AIRS OLR is computed from AIRS retrievals using a forward algorithm, originally developed for TOVS
  - Four (?) bands forward algorithm
- Integral over all angles at the time of satellite observation (1:30 AM & PM)
  - CERES estimates daily mean OLR
- A bug in AIRS version 4.0.9 was fixed
  - Cloud top of higher cloud was not used
  - OLR was biased low in areas with high clouds
- AIRS Level 3 OLR at 1 by 1 degree was compared to CERES OLR (ERBE type level 3 at 2 by 2.5 degrees)
- AIRS Global means match NCEP GFS very well, but are biased high with respect to CERES
  - Consistent with out of date CO_2 mixing ratio (?)
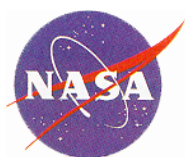
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
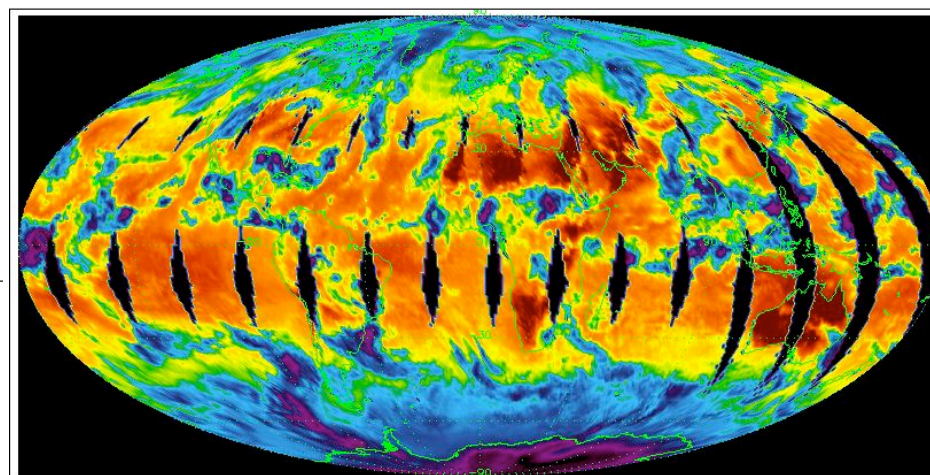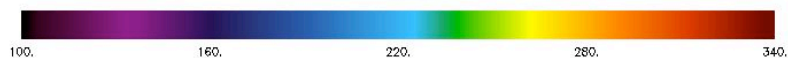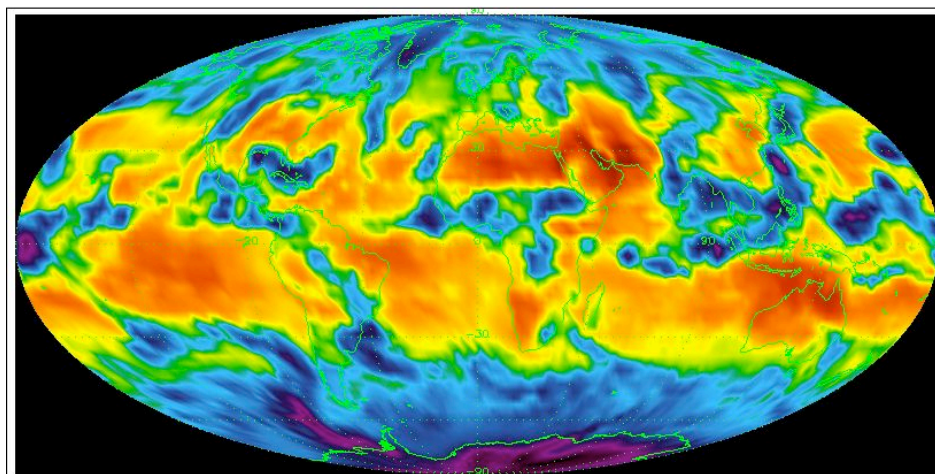California Institute of Technology
Pasadena, California

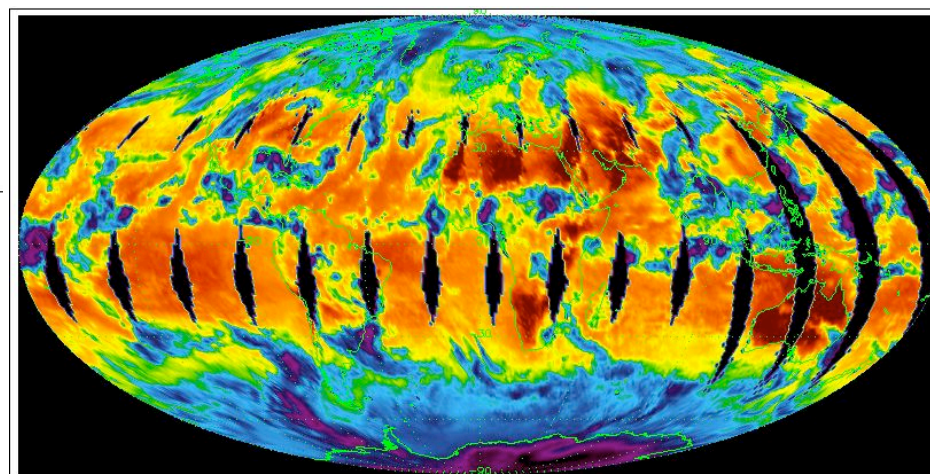# Daily Mean OLR for Sept 6, 2002
Comparisons with CERES
SYL

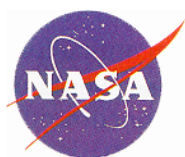**Baseline AIRS Only
Total OLR**

**CERES
Total OLR**

**AIRS/AMSU
Total OLR**

March 29, 2007
Granger, Lee, Manning

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

CERES
Clear OLR

Baseline AIRS Only
Clear OLR

Zonal Mean Comparison
SYL

OLR Comparison : Thick(Cloudy), Thin(Clear), Black(AIRS), Blue(CERES), Red(AVN)
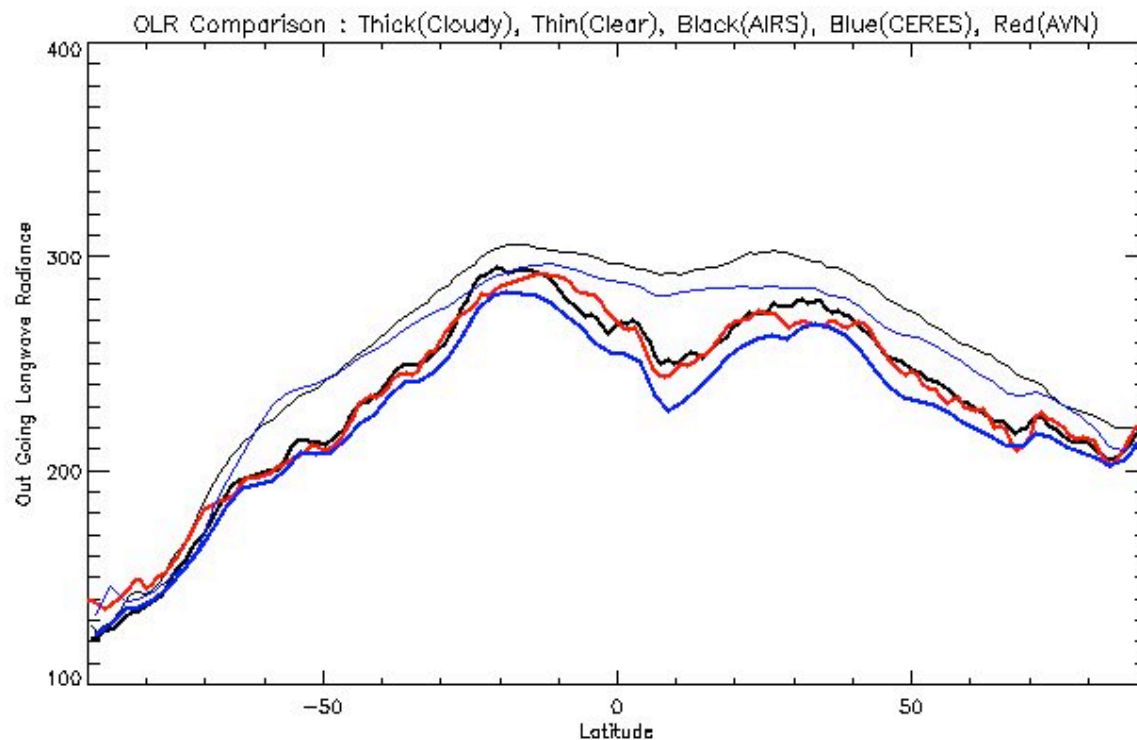
- Thin curves are for clear sky
- Thick curves are for total
- Blue curves are for CERES
- Black curves are for AIRS
- Red curve is for NCEP GFS

- For September 6, 2002
- CERES is biased low, for both clear and cloudy
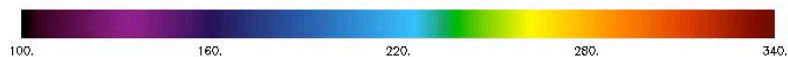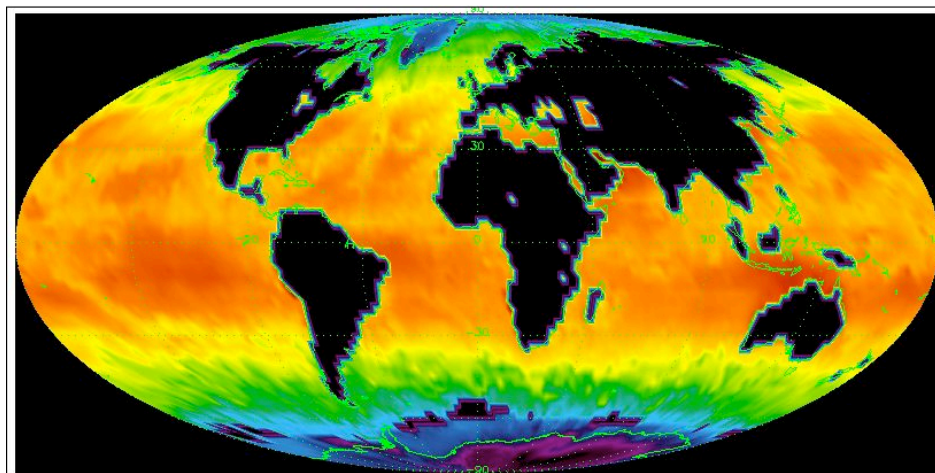- AIRS and NCEP matches very well
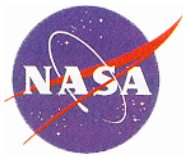
National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

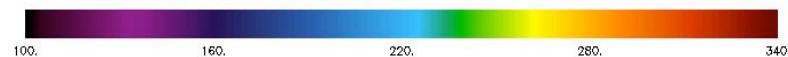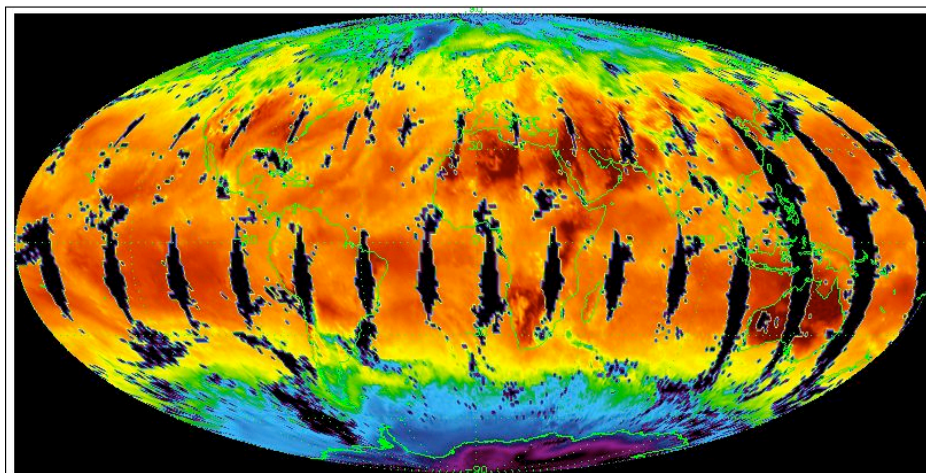Global Mean OLR Trend: Black(AIRS), Red(AVN), Green(CERES)
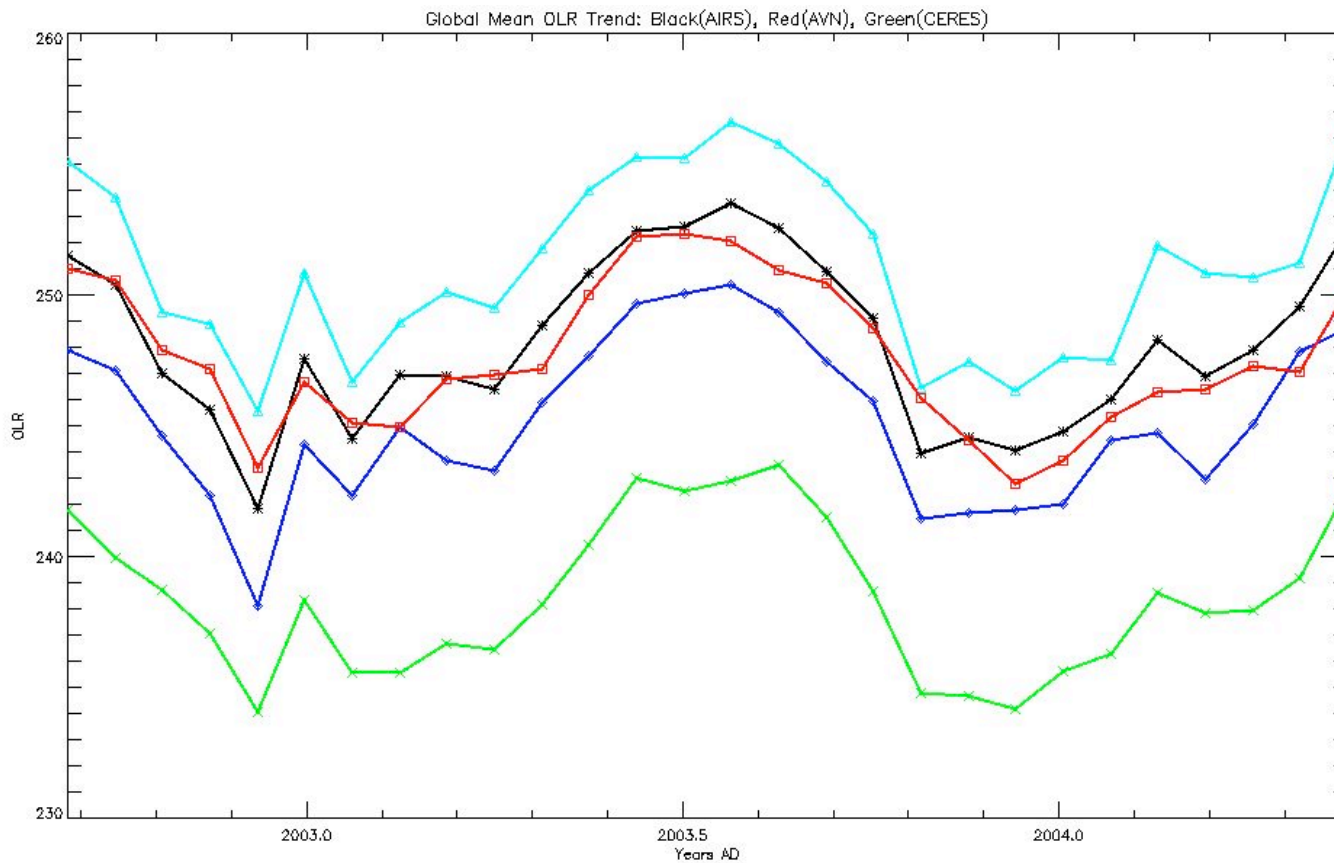
- Black curve is for AIRS
- Cyan curve is for AIRS ascending
- Blue curve is for AIRS descending
- Green curve is for CERES
- Red curve is for NCEP GFS

- For focus days (Sept 6 2002 and 48 day cycle since Sept 29, 2002)
- CERES is biased low, by about 10 watts/m^2
- AIRS and NCEP matches very well

March 29, 2007
Granger, Lee, Manning

L3 Support Product 1
v5.0 (delta)

- Delta v5.0 delivery to the DAAC
  - June 1, 2007 timeframe.
- Philosophy
  - Support AIRS Science Team research and experimentation.
  - Support the continuation of heritage products for on-going climate studies.
  - Support future AIRS-like missions.
  - Provide a framework for analysis of proposed AIRS Level 2 and 3 Standard products prior to inclusion.
  - Provide a test-bed for quality indicators.
  - Provide a framework for global monitoring of algorithmic changes.

L3 Support Product 2

- Approach
  - Two classes of data
    - Diagnostic: never intended for public use, ex. Diagnostics, flags…
    - Science: candidates for inclusion into L2 and L3 standard products
  - CCB-like process for inclusion of science parameters in L3 support
    - Researcher submits concept paper outlining research approach and initial requirements for panel review.
    - Proposers "own" accepted parameter.
      - Responsibility for delivery of requirements and algorithms.
    - L3 Support considered as candidate for inclusion into L2 Standard based on peer-reviewed publications.
- Parameters
  - Available upon request.

Video Featuring AIRS v5.0 CO

- Create a demand for remote sensing measurements of Earth's environment from wider audiences - R. Friedl
- Measurements of AIRS and TES CO as a result of the Esperanza Fire
- JPL Executive Council Retreat

March 29, 2007
Granger, Lee, Manning

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Thank you.

Questions?